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Evidence and Implications of Weight Clustering Among Adolescents

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Evidence and Implications of Weight Clustering Among Adolescents

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Abstract

Both obesity and eating disorders (ED) are increasingly conceptualized from an ecological model of health, which emphasizes the importance of individual and contextual variables. The peer context is particularly important for understanding adolescents' weight related attitudes and behaviors; however, specific peer processes that impact obesity and EDs are unclear. Because social comparison is common during adolescence, how teens view their body in comparison to the body size of their close friends may be influential. The purpose of this study is to examine how adolescents' perceptions of their friends' body sizes relate to their weight-related cognitions, behaviors, and mental health symptoms, and to identify peer processes that mediate these associations. Adolescents provided self-report on weight related cognitions and behaviors including: defining self as overweight, dieting, exercise, body satisfaction, ED symptoms, and depressive symptoms. Using a figure rating scale, participants also reported on their figure size and the sizes of their four closest friends. Analyses indicated that adolescents who rated themselves as having a larger figure also had friends who they perceived as relatively large (i.e., weight clustering). For girls but not boys, the perceived size of friends (e.g., rating of largest and thinnest friend) predicted whether or not the adolescent identified as overweight, felt body dissatisfaction, engaged in recent dieting, and endorsed ED symptoms, beyond the effect of BMI and self figure rating. There was some indication that peer group preoccupation with weight may mediate these effects, although in general there was little support for the potential mediating mechanisms tested. Results provide additional evidence of weight clustering among peer groups, and indicate this clustering may have an impact on how adolescents view their weight. Consequently, prevention programs that address negative aspects of social comparison or are delivered in peer groups may be especially important.

Evidence and Implications of Weight Clustering Among Adolescents

Obesity is a critical public health problem because of its prevalence, chronicity, and cost. The United States has seen a startling increase in adolescent's body weight, with adolescent obesity rates almost doubling from 1994 to 2008. Currently, approximately 18% of adolescents meet obesity criteria and 34% are at risk for obesity or obese (Odgen, Carroll, Curin, Lamb & Flegal, 2010). Although the prevalence of obesity has increased in all socioeconomic and racial/ethnic groups, youth who grow up in a low-income household have the highest obesity rate. A review of studies conducted in the past 15 years demonstrated a strong inverse relationship between SES and childhood and adolescent obesity (Shrewsbury & Wardle, 2008). When measured at the population level, socioeconomic status accounts for almost 40% of the variance in obesity among adolescents (Goodman, Slap, & Huang, 2003). In addition to income, race/ethnicity has also been identified as an important predictor of the onset of overweight and obesity (Rehkopf, Laraia, Segal, Braithwaite, & Epel, 2011). Among adolescents of color, African-American and Latino adolescents are disproportionately affected by this epidemic. In a nationally representative sample of adolescents, 45% of African-Americans, 37% of Latinas, and 31% of Whites were at-risk for obesity, as indicated by Body Mass Index (BMI) <85th percentile (Ogden, Carroll & Flegal, 2008).

Obese children and adolescents are at increased risk for adverse health conditions, such as elevated blood pressure, diabetes, cholesterol, and obesity in adulthood. There is also evidence that obesity during adolescence may impact subsequent academic achievement (Crosnoe, 2007) and mental health (Merten, Wickrama & Williams, 2008). Overall, the cost of childhood and adolescent obesity, including prescription drugs, outpatient and inpatient care, and emergency room visits, is currently estimated to be at least $14 billion annually (Marder &

Chang, 2006; Trasande & Chatterjee, 2009).

As concern about adolescent obesity increases, it is important to remember that this age group also has a high prevalence of eating disorders (EDs) and sub-threshold eating conditions. Adolescents with sub-threshold symptoms are more likely to develop future disordered eating and show many of the same functional impairments as adolescents meeting full diagnostic criteria (Goldschmidt, Wall, Loth, Le Grange, & Neumark-Sztainer, 2012). Lifetime prevalence rates for adolescents between the ages of 13-18 for anorexia nervosa, bulimia nervosa, and binge eating disorder are 0.3%, 0.9%, and 1.6% respectively (Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011). These rates double when sub-threshold symptoms are considered, and are higher among girls (Stice, Mari, Shaw, & Jaconis, 2009). Individuals with disordered eating are likely to have comorbid mental and physical health problems (Lock, Reisel, & Steiner, 2001). For example, adolescents with disordered eating have more symptoms of depression than healthy peers (Brausch & Gutierrez, 2009), and in longitudinal studies ED symptoms contribute to increases in depressive symptoms over time (Presnell, Stice, Seidel & Madeley, 2009). Although somewhat counterintuitive, disordered eating may in fact contribute to the obesity epidemic since many ED symptoms are associated with weight gain, rather than weight loss, overtime (Neumark-Sztainer, Wall, Story, & Standish, 2012). Thus, while national attention is heavily focused on obesity, both obesity and EDs among adolescents are critical public health issues.

Both obesity and disordered eating are increasingly viewed within the context of an ecological model of health, incorporating biological, psychological, social, and ecological factors. Earlier health and medical models of weight and disordered eating focused on individual factors, such as genetic predisposition, or lack of information or motivation. In the past decade,

however, ecological models have gained increasing evidentiary support (for reviews, see Ellen, Mijanovich, & Dillman, 2001; Schaefer-McDaniel, Caughy, O'Campo, & Gearey, 2010). Ecological models acknowledge the importance of individual level behaviors, but also emphasize the influence of the contextual variables that shape these behaviors, including parental and peer factors, the focus on weight and body figure in the media, the built environment, food prices, and school nutrition policies (Koplan, Liverman, Kraak, 2005).

In understanding obesity and EDs among adolescents, social factors may be particularly important due to the increasing social influences on youth as they enter adolescence. During this developmental period, youth are more socially self conscious, increasingly value their appearance and attractiveness, and have a greater focus on self-identity (Rankin, Lane, Gibbons, & Gerrard, 2004; Ryan & Kuczkowski, 1994). Adolescents also spend majority of their time with peers and are often victims of peer pressure. For example, the social influence of peers on adolescent's dieting behavior is well established. The literature suggests that adolescents both model and conform to peers dieting behaviors and peer pressure (Shomaker, & Furman, 2009; Paxton, Schutz, Wertheim, & Muir, 1999), and in a sample of adolescent and young adults diagnosed with Bulimia or subclinical Bulimia, individuals with an ED reported more pressure to be thin from friends than controls (Stice, Shaw, & Nemeroff, 1998). Social influence not only impacts weight, but also how an adolescent perceives their body. In one prospective study, an adolescent girl's friend's dieting behavior predicted her own body dissatisfaction (Paxton, Eisenberg, Neumark-Sztainer, 2006). Thus, there is a clear need to further explore the social influence on both disordered eating behaviors and obesity.

The current paper will examine the role of one social factor, namely weight clustering among peers, on weight-related cognitions and behaviors that have been associated with obesity

and EDs in a sample of low-income adolescents. Four questions are addressed: (1) do adolescents' perceived body shapes correlate with the way they perceive the body shapes of their closest same sex friends, (2) are the perceived body shapes of peers (i.e., figure size of thinnest friend or heaviest friend) associated to weight related cognitions and behaviors, such as adolescents viewing themselves as overweight, dieting, exercising, experiencing ED symptoms, body image concerns, or depressive symptoms, (3) do the above relations differ by gender or race/ethnicity, (4) are the body shapes of close friends related to peer weight related process variables, such as peer preoccupation with weight, peer attributions about weight, and negative peer communication about weight.

The Social Context of Obesity

In the adult literature, there is well-founded evidence that peers influence an individual's weight. In 2007, Chistakis and Fowler published an influential study on the spread of obesity in social networks. They found that an individual's chance of becoming obese is greatly increased if they have a friend or sibling who became obese over time, with a 57% increase in chance of becoming obese if the person's friend became obese within a certain time period. Same sex and mutual friends had a greater influence than opposite sex and non-reciprocated friendships, with closer social ties rendering a greater risk for obesity (Christakis & Fowler, 2007).

As in the adult literature, both family and peer influence have been recognized as influential to unhealthy weight related behaviors in adolescence (Lattimore & Butterworth, 1999). During adolescence, youth tend to cluster into peer groups with others who are similar to them, and within these groups, members influence each other's behavior (Dishion & Owen, 2002). The clustering of adolescents with similar health behaviors is apparent throughout the literature on adolescent's risky health behaviors, suggesting adolescents who engage in behaviors

such as smoking, alcohol and drug use, and unsafe sex are more likely to have friends who engage in similar risky behaviors (Clark & Loheac, 2007; Hair, Park, Ling, & Moore, 2009; Balsa, Homer, French, & Norton, 2011).

Less work has been done to look at social clustering by weight among adolescents. The term "social clustering of weight" describes the phenomenon that individuals tend to be friends with people who are a similar weight to them. For example, there is evidence suggesting adolescents with a higher BMI tend to have friends with a higher average BMI (de la Haye, Robins, Mohr, & Wilson, 2011, Hurschka, Brewis, Wutich, & Morin, 2011; Trogdon, Nonnemaker, & Pais, 2008). There is also evidence that members of adolescent social groups may hold similar weight related values that could influence weight (Yli-Piipari, Kiuru, Jaakkola, Liukkonen, & Watt, 2011). Although past research provides some evidence for clustering of obesity in adolescent social networks, it is unclear if adolescents choose a peer group that is reflective of their own values, adopt the values of their peer group, or perhaps do both.

The mechanisms of the transmission of obesity are still unclear. One hypothesis suggests that an individual's likelihood of becoming obese increases if the person has a social connection with another obese individual; this is considered the "contagion" hypothesis (Chistakis & Fowler, 2007). Because adolescence is a critical point in development when young people are highly susceptible to peer evaluation and peer pressure, this hypothesis may be particularly salient when considering this age group. In the contagion model, peers may influence each other's weight through a variety of mechanisms. Cognitively, an individual's perceptions of ideal weight may be influenced by social norms, such as weight norms (Burke & Heiland, 2007), or they may compare themselves to their peers, using their friends as "weight referents." For example, if an adolescent has friends with larger body shapes, his or her own standard of what is

"overweight" may change and become larger, leading the adolescent to underestimate their own weight status (Maximova et al., 2008). Behaviorally, peers and friends may also promote weight related behaviors. In a sample of college students, young adults were influenced through direct modeling on what their peers ate and how much physical activity they participated in (Lau, Quadrel & Hartman, 1990).

Though research indicates that friends' weight related behaviors become more alike over time, we also know that teens tend to select friends who engage in similar behaviors to them. "Homophily" is the tendency for an individual to associate with someone who is similar to him or her. Research shows that adolescents tend to have friends who engage in similar weight related behaviors, especially leisure behaviors (de la Haye, Robins, Mohr & Wilson, 2010). Indeed, thinner students tend to "select" equally thin students in making new friends (de la Haye et al., 2011). Thus, the homophily hypothesis proposes that adolescents choose friends who have similar body shapes and engage in similar weight related behaviors. Regardless of how weight clustering occurs (e.g., spreading vs. selection), the fact that it exists has potential implications for adolescent obesity and EDs. Specifically, because of social comparison and social norms, the size of one's close friends may influence how an adolescent judges her own body, and whether she engages in efforts (healthy or unhealthy) to change her weight.

Social Comparison and Social Norms

The theory of social comparison states that an individual's drive for self-evaluation is based on their desire to compare themselves and their group to people in different groups (Festinger, 1954). Research demonstrates that when an individual who is a member of a non-stigmatized group compares themself to a member of a stigmatized group, the individual may experience psychological benefits (Karpinski, 2004; Taylor & Brown, 1988; Suls & Martin,

2001). This is particularly relevant when thinking about people who are overweight/obese as members of a stigmatized group. According to this theory, when members of a normal weight group (non-stigmatized) compare themselves to members of an obese group (stigmatized), they likely experience positive outcomes such as higher self-esteem and body satisfaction. Indeed, research exploring social comparison among adolescents indicates that the figure sizes of adolescent's peers may act as sources for social comparison, and that this act of comparison is associated to the adolescent's self-evaluation and weight control behaviors (Mueller, Pearson, Muller, Frank, & Turner, 2010).

When considering the current study in the context of social comparison, if an adolescent's closest friends are all relatively large, she may view her own shape more favorably, and not identify as overweight even if she is indeed overweight. Although the adolescent's self-evaluation of her weight as "normal" may have a negative impact on her physical health (e.g., if it keeps her from engaging in weight reduction strategies), this perception may actually be protective for her mental health. Indeed, obese/overweight people who rate their traits as more similar to normal weight individuals than obese individuals also report better psychological well-being (Carels et al., 2013). Alternatively, if an adolescent views herself as larger than all of her friends, regardless of her actual body shape, this social comparison may contribute to body dissatisfaction and related mental health issues such as disordered eating or mood disorder symptoms (Fitzsimmons-Craft, Harney, Brownstone, Higgins, & Bardone-Cone, 2012).

Closely linked to the theory of social comparison is the concept of social norms related to body weight. In areas where many youth are overweight, such as in low-income communities, adolescents are surrounded by overweight and obese peers and in turn may contribute to a perception of a "normal" shape that is increasingly large. Epidemiological literature suggests

there has been a recent shift in body weight norms among adolescents, with the 17-19 year old group experiencing a significant decrease in the number of overweight and obese participants who accurately identify themselves as overweight or obese from the time periods 1988-1994 to 1999-2004 (Burke, Heiland, Nadler, 2010). As we see this upward shift in weight norms, we also continue to see the influence of norms on social clustering. Hruschka et al. (2011) found that social norms account for a significant proportion of the BMI clustering effect, with an individual's desired body size accounting for 20% of the variance of a peer's BMI on their own BMI.

Not only do social norms influence an adolescent's perception of healthy weight, they also may have an impact at the behavioral level. Ajzen's theory of planned behavior states that attitudes towards a behavior, subjective norms, intentions, and perceived behavioral control shape an individual's behaviors (Ajzen, 1991). Of particular interest is the emphasis this theory places on subjective norms as a key determinant of health behavior. In fact, many theories that emphasize the normative influence have been applied widely to studies of health behavior, such as exercise and diet (Pickett et al., 2012). Overeating is a main contributor to unhealthy weight, and research has demonstrated that people eat more when the individuals they are eating with eat more, and eat less when the people they are around eat less, especially when the participant was normal weight and perceived the other individual as normal weight (Hermans Larsen, Herman, Engels, 2008; Romero, Epstein, Salvy, 2009). Adolescents often misperceive how often their peers are eating healthy foods, thus it is likely that as result of the perceived social norm that everyone eats unhealthy foods, adolescents are eating less healthy foods themselves (Lally, Bartle & Wardle, 2011). In the same way, perceived peer norms around weight (i.e., the body

size of close friends) may influence if adolescents engage in efforts to change their body size (Eisenberg, Neumark-Sztainer, Story & Perry, 2005).

Weight norms also appear to play a role in adolescent eating disorders. For example, when college age women perceive their weight as discrepant from others on their campus, they report more symptoms of disordered eating (Sanderson, Darley & Messinger, 2002). Likewise, for both male and female young adults, perception of the weight practices of their close, same-sex friends predicts unhealthy weight control behaviors, and is more predictive of unhealthy weight control practices than actual weight (Clemens, Thombs, Olds, & Lowry Gordon, 2008). In a longitudinal study of college roommates, female's college roommates' dieting predicted ED symptoms and drive for thinness at the 10-year follow-up (Keel, Forney, Brown & Heatherton, 2013).

It is important to note that previous research on clustering of BMI, obesity, and dieting has been based on actual weight measurements. This objective measurement is critical because other measures of weight, such as self-reported weight, can be biased and inaccurate, particularly among individuals who are larger or those with eating disorder symptoms. However, actual weight and BMI do not always correspond with perceived body shape among adolescents, and in fact, perceived body shape is more related to weight specific quality of life than BMI (Edwards, Patrick, Skalicky, Huang & Hobby, 2012). For example, adolescent girls with larger breasts may have a high BMI, but have a body shape seen favorably by herself or her peers. Consistent with this view, there is evidence that an adolescent's perceived body shape is a much stronger determinant of weight related behaviors and beliefs than their actual weight (Conner, Martin, Silverdale & Grogan, 1996; Seo & Li, 2012). To date, however, researchers have generally not examined if there is clustering of perceived body shapes. In other words, there is a need to

investigate if adolescents who view themselves as relatively thin or heavy tend to have friends that are also relatively thin or heavy.

Thus, the first research question addressed in this study is whether there is similarity in how adolescents perceive their own body size and how they perceive the body size of their closest friend. The size (or perceived size) of peers may relate to behaviors and cognitions associated with obesity and body image, weight management, and mental health. Having larger friends may make adolescents more accepting of their own weight; these adolescents may be less likely to define themselves as overweight even when they are, or may be less likely to be engaged in efforts to change their weight (e.g., diet or exercise). In this way, being overweight may "spread". Conversely, having a relatively thinner friend may make adolescents hold more negative views of their own weight, which may lead to disordered eating behaviors, poor body image, or depression. Consequently, understanding how the weight of close friends' is associated to an adolescent's weight, as well as how it relates to adolescent weight related cognitions and behaviors, will contribute to our understanding of both disordered eating and obesity.

The second research question addressed in this study is whether the perceived body shape of adolescents' closest friends is associated with weight related behaviors and cognitions. We focused on three types of outcomes potentially influenced by perceived peer body shapes: 1. *adolescents evaluation of their own weight* (whether they judge themselves as overweight and body dissatisfaction), 2. *weight related behaviors* (recent exercise and dieting), and 3. *mental health outcomes* (depressive symptoms and disordered eating). Exploring the influence of the perceived size of an adolescent's peers on their weight related cognitions and behaviors will help us understand the consequences of social influence on adolescents' overall well being. Work has

been done to explore the mediating factors in the relationship between peer influence and body dissatisfaction (Keery, van den Berg, Thompson, 2004), and also the relationship between peer influence and weight control behaviors such as eating patterns and exercise behaviors (Chambers & Swanson, 2006; Mackey & La Greca, 2008). However, more work is needed to understand the influence of close friends on weight related cognitions and behaviors.

Potential moderators: Gender and race/ethnicity

The relation between perceived size of friends and weight related cognitions may not be the same for all adolescents. The third research question will address whether the above relations differ by gender and race/ethnicity. In most studies of social influences on weight and weight-related behaviors and cognitions, either no effects of gender are found, or there are stronger influences on females (Nishina, Ammon, Bellmore, & Graham, 2006). Although several studies have found similar outcomes for girls and boys, other work has shown that girls are more likely than boys to be dissatisfied with their weight (Delfabbro, Winefield, Anderson, Hammarstrom & Winefield, 2011), thus it is important to consider the differential social influence on girls versus boys.

A focus on shared norms may also be important for understanding racial/ethnic disparities because the obesity epidemic is most evident in low-income communities and in adolescents of color. These communities are also ones in which the obesity rate is highest. As a result, adolescents in these communities may be more regularly exposed to larger body shapes, and as a result have a different view of what constitutes being "overweight". Therefore, it is of particular importance to understand if this is a product of unique messages about body image and acceptable weight. Previous studies aimed to parse out racial differences and found that African Americans prefer a larger figure size, and report a larger ideal body image in comparison to

Whites (Killion, Hughes, Wendt, Pease, & Nicklas, 2006; Kronenfeld, Reba-Harrelson, Von Holle, Reyes, & Bulik, 2010). A larger ideal body size may influence how much an individual views themself as overweight, and how much they may be motivated to engage in behaviors to decrease their weight. Likewise, African American adolescents are more satisfied with their bodies in comparison to Caucasian, Latino, and Asian teens. However, this was only true for females (Nishina et al., 2006). Previous research on peer influences on weight has focused on White college young adults (Leahey, LaRose, Fava & Wing, 2011) or White, middle class adolescents in a relatively homogeneous area (de la Haye et al., 2011). Thus, given the lack of focus on this population regardless of the evidence of racial/ethnic differences in weight, weight related behaviors (e.g. dieting), and cognitions (e.g., body dissatisfaction), it is important to consider how relations might differ by race/ethnicity. Thus, more work is needed to fully understand the relationship of social processes such as social comparison or norms, by gender and racial/ethnic norms, to analyze the ways in which peers influence adolescents' view of their own weight and body satisfaction.

Peer processes as potential mediators

The final goal of the current study is to identify peer process variables that may mediate the relation between perceived size of peers and weight related cognitions and behaviors. Based on social comparison and social norm theory, how an adolescent perceives the size of her friends may lead to specific judgments about her own body shape. From this perspective, this evaluation may be internal or implicit. However, it is also possible that weight-similar peer clusters differentially engage in specific activities, and it is these activities that lead to differential weight-related cognitions or behaviors. For example, certain groups of peers engage in more negative conversations about the size and shape of their body, and research indicates that these

groups also value the thin ideal more than groups who do not talk about weight (Salk & Engeln-Maddox, 2011). Girls who engage in negative conversations about weight with friends are also more likely to have body dissatisfaction and weight related guilt (Lawler & Nixon, 2011; Salk & Engeln-Maddox, 2011). Because of weight stigma, groups of heavier peers also may experience more teasing or negative comments from other students, or may believe their social standing is influenced more by weight and shape. Thus, the current study will also examine potential peer process variables (negative comments about weight, friend preoccupation with weight, and appearance based social standing beliefs) that may mediate the relation between perceived size of peers and weight related cognitions and behaviors. It is possible that these factors are the mechanism by which friends' body shapes (e.g. being part of a cluster of relatively large or small peers) impact weight related cognitions or behaviors.

In summary, the goal of the present study is to examine: (1) whether there is evidence of weight clustering when weight is based on perception of body size, (2) how adolescents' perceptions of their friends body size is related to judgments about their own weight, body satisfaction, dieting and exercise behaviors, and weight-related mental health symptoms, (3) whether relations differ by gender or race/ethnicity, and (4) if peer processes mediate these relationships. The study was conducted in a diverse, low-income city to better assess peer influences in a community at elevated risk for obesity.

Methods

Participants

The current sample included 409 9th grade students from a public high school in a low-income, central Connecticut city. Youth ranged from 14 to 17 years of age (M = 14.91, SD = .62). The sample was 50.9% male and 49.1% female. Of the participants, 50% were Latino, 22%

were African American, and 22% were White. Students in this study broadly matched the overall school population on race/ethnicity. Almost 40% of students at this high school have a non-English speaking home, with immigrants from Latin America and Poland being the largest immigrant groups. Majority of the student body at the high school where participants were recruited are from low-income households.

Procedure

This study was conducted in conjunction with the school-based health center (SBHC) at the high school, which serves as primary care provider to 70% of the student population. The SBHC targets students who are underinsured or uninsured and provides them with a comprehensive array of primary care, mental health and dental services. In an effort to inform school-wide health initiatives, the SBHC along with a health advisory board at the high school determined the need for additional information regarding peer influences on weight-related cognitions and behaviors.

The SBHC conducted an anonymous survey during Health class, a course taken by all ninth grade students at the school. Students were provided with a verbal and written description of the purpose of the study and the voluntary and anonymous nature of participation. Students were also provided with time to ask questions. Next, they were asked to provide written consent. Any student who did not wish to participate was given alternative Health curriculum materials to work on during the class. The survey was administered to students over a two-day period. Participants provided self-report on measures of demographics, body image, peer contextual factors, and depressive symptoms. Surveys were collected without any identifying information; consent forms were collected separately from the survey data.

Measures

Perceived Body Size. The *Figure Rating Scale* (FRS; Stunkard, Sorenson, & Schlusinger, 1983) includes two series of nine schematic figures, one series with male figures and one with female figures. The figures range in size from underweight to overweight and in the larger study adolescents were asked to select the figure that best depicted their current body shape (actual) and the figure that represented the body shape they would like to have (ideal). In the present study, only adolescents rating of their "actual" shape was used to reflect current perceived body shape.

Close Friend's Perceived Body Size. Adolescents were given a form in which they were asked to identify their four closest friends by initials and indicate each individual's race/ethnicity, gender, age, relationship to the participant, and perceived figure rating on the *FRS* (Stunkard et al., 1983). This information was used to determine the demographics and perceived body size of individuals closest to the participant. For the current study, the largest and smallest rating given to same-sex friends (i.e., minimum and maximum score on the FRS ratings given to the four friends) were calculated to reflect the perceived size of each participating adolescent's heaviest and thinnest close friend.

Weight Control Practice. 3 Items from the Youth Risk Behavior Surveillance Survey *(YRBSS; CDC, 2010)* were used to assess weight perception and control practices. Adolescents were asked to describe their perception of their weight as "Very underweight," "Slightly underweight," "About the right weight," "Slightly overweight" or "Very overweight." For the present purposes, responses were dichotomized to reflect whether the adolescent reported they were slightly or very overweight or not. Adolescents also indicated whether they were trying to "Lose weight," "Gain weight," "Stay the same weight," or "not trying to do anything about my weight." This outcome was also dichotomized, and participants were considered to be trying to

lose weight or not trying to lose weight. Participants were asked to answer "yes" or "no" to whether they exercised to lose weight or keep from gaining weight in the past 30 days.

Body Dissatisfaction. To measure the participant's self evaluation of their body shape, the present study includes the *Appearance Evaluation Scale* (AE); a 6-item measure used to assess body satisfaction (Cash, Winstead, & Janda., 1985,1986; Brown, Cash, & Mikulka, 1990). The measure uses a 5-point Likert scale, with responses ranging from (1) "definitely disagree" to (5) "definitely agree." For example, participants were asked how much they agree or disagree with the statement "I am physically unattractive." (AE, α= .81).

Mental health. *The Adolescent Psychopathology Scale-Short Form was used to measure depression and eating disorder symptoms.* This APS scale is a multidimensional measure of psychopathology and personality characteristics designed for use with adolescents (APS; Reynolds, 2000), The APS-SF is composed of 12 clinical scales and 2 validity scales. The Major Depression (DEP) scale was used in the present study, and is comprised of twelve items that evaluate specific depressive symptoms based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; American Psychiatric Association, 1994) diagnostic criteria for Major Depressive Disorder. The measure uses a 3-point Likert scale. Scores range from (1) "almost never" to (3) "nearly every day." Higher scores indicate increased depressive symptomatology. The Eating Disturbance scale assesses behaviors found in eating disorders. The scale includes five items specific to Anorexia Nervosa evaluate a fear of getting fat and gaining weight, perceptions of gaining weight even with weight loss, and fear of overeating over the past 6 months. Scores range from (1) "never or almost never" to (3) "nearly all the time," with higher scores indicating increased disordered eating. The remaining three items on the scale are specific to Bulimia Nervosa and evaluate secretive eating and purging behavior over the

past 3 months. Scores range from (1) "never" to (3) "once or twice per week," with higher scores indicating increased disordered eating. (DEP, α= .92; ED, α= .82)

Peer Process Variables. *Perceived Friend Preoccupation with Weight and Dieting Scale* (Paxton et al., 1999; Shroff & Thompson, 2006). This 4-item measure assesses weight and dieting preoccupation and perceptions of the general importance of weight among friends. Respondents indicated how often they and their friends talk about what they would like their bodies to look like, and how often their friends comment on other's weight and body shape, worry about their own weight, and take notice of other's weight and shape. Participants indicated the frequency at which each item occurs on a 5-point Likert scale ranging from (1) "never" and (5) "always." Scores were obtained by calculating the mean score for all items. This measure has been shown to have excellent internal consistency with an adolescent female sample (Thompson et al., 2007; α= .82).

The Peer Attribution Scale (PAS; Lieberman, 2000). The PAS is an 4-item subscale, drawn from a 23-item measure developed to assess peer modeling, social reinforcement, and peer attributions. The PAS assesses attributions made about how one's peer standing relates to appearance, and is comprised of items such as "I would be more popular if my weight was different" (α =.81).

Negative & Positive Communication Scales. The Negative & Positive Communication Scales (NCS & PCS; Kichler & Crowther, 2001) assesses the perceived frequency of negative or positive familial and peer communication. The present study included only the one item that asked "how frequently have your friends made negative comments about your physical appearance." Participants indicated the frequency at which the item occurs on a 5-point Likert scale ranging from (1) "never" and (5) "always." (Kichler & Crowther, 2001).

Demographics. Participants completed a measure assessing relevant demographic characteristics including age, racial/ethnic background, gender, birth country, parents' birth country, bilingualism, and family structure. Participants also reported their height and weight, which was used to estimate their Body Mass Index (BMI) according to the BMI table of the Center for Disease Control and Prevention (CDC; 2011).

Data analytic plan

Gender differences in variables of interest (self FRS & friend FRS) were tested with independent t-tests. Pearson correlations were used to examine associations between adolescent's self-reported BMI, self-rating on the FRS, and FRS ratings given to their close friends. Logistic regression was used to examine whether the maximum and minimum perceived size of closest friends predicted adolescents' definition of self as overweight, desire to lose weight, and exercising to lose weight (categorical outcomes). Linear regression was used to examine how these same variables predicted body image, eating disordered behaviors, and depressive symptoms (continuous outcomes). In all analysis, gender, race/ethnicity, BMI, self-reported body shape, and racial/ethnic makeup of friends were used as covariates.

Potential gender and racial/ethnic differences were examined using SEM nested model comparisons (Byrne, 2001). In nested model approaches, the same model is generated for different groups (e.g., boys vs. girls) with parameters of interest estimated simultaneously under two sets of conditions. In the default condition, parameters for the two groups are free to vary. In the alternate condition, constraints are added forcing an estimated parameter (e.g., regression weight of heaviest friend on eating disorder symptoms) to be the same in the two groups. If the model in which parameters are constrained to be equal provides a significantly worse fit to the data then the unconstrained model, the parameter of interest is not equivalent across groups,

indicating an interaction or moderating effect. In situations where the chi square differential was significant, follow-up critical ratio z-tests were used to test specifically which paths (e.g., heaviest friend or thinnest friend) specifically differed by gender.

Following these analyses, potential mediation of peer process variables was tested using the PROCESS macros (Hayes, 2013). This macros tests for the significance of indirect effects using boostrapping, a non-parametric resampling procedure that is preferred over Sobel tests because it does not assume normality of the sampling distribution (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).

Analyses were conducted in SPSS 19, AMOS 19, and Mplus 7.

Power Analysis

The sample size of 409 participants will provide sufficient power (1- β = .80) to detect a small effect sizes (r = .20) with alpha set at .01 for the correlations, logistic regression, and path analyses. The sample size for both males (n = 208) and females (n = 201) was large enough to detect a medium effect size (1- β = .80) at the alpha .05 level in tests for the moderation of gender. The sample size for Latino (n = 205), Black (n = 88), and White (n = 88) was large enough to detect a large effect size (1- β = .80) at the alpha .05 level in tests for the moderation of race.

Results

Descriptive Statistics

Characteristics of the study sample. Thirty-four percent of adolescents were overweight or obese in this sample, with 12.2% meeting the CDC criteria for obesity (CDC; 2011).

Gender Differences. See Table 1 for descriptive statistics by gender for all outcome variables, as well as t-tests and chi-square analyses for gender differences. Females chose significantly smaller figures when reporting their perceived body size (as measured by the FRS self rating scale) (M = 4.34, SD = 1.30) in comparison to males (M = 4.77, SD = 1.27; t (406) = 3.38, p = .001). Females also reported their smallest friend (as measured by the FRS peer rating scale) to be significantly smaller (M = 3.00, SD = 1.10) than males rated their smallest friend (M = 3.37, SD = 1.08; t (409) = 3.36, p = .001). There were not significant differences in the average figure size of females' largest friend (M = 5.48, SD = 1.27), in comparison to the average figure size of males' largest friend (M = 5.63, SD = 1.40; t (409) = 1.27, p = .209).

Racial/Ethnic Differences. See Table 2 for descriptive statistics by race/ethnicity, and ANOVA and chi-square analyses for racial/ethnic differences. A one-way between-groups analysis of variance was conducted to explore the racial/ethnic differences in BMI. There were significant differences in average BMI among adolescents who identified their race/ethnicity as Black, Latina, White, or Other, F (3, 363) = 5.53, p = .001. There were no differences in average self-rated figure size, average figure size of thinnest friend, or average figure size of heaviest friend.

Research Question 1: Evidence for weight clustering

The relationship between the participant's report of their own figure size and perceived figure sizes of their closest friends was investigated using the Pearson product-moment correlation coefficient. Given racial/ethnic similarity in peer groups and racial/ethnic differences in weight, partial correlations were run controlling for the percent of the four friends who were White to reduce this potential confound. See Table 3 for Pearson correlations by gender and by race for the following correlations; self figure size rating and thinnest friend figure size rating,

self figure size rating and largest friend rating, and thinnest friend rating and heaviest friend rating.

There was a small, positive correlation between the self figure size rating and the rating for the thinnest friend, $r(403) = 0.18$, $p < .001$, and a medium correlation between the self rating and the rating for the largest friend, $r(403) = 0.27$, $p < .01$, as well as between the rating the adolescent gave for their thinnest friend and the rating for their largest friend, $r = 0.34$, n = 406, $p < .001$. In other words, adolescents who tended to see themselves as having a relatively large figure compared to peers also had friends who they viewed as relatively larger, and if their smallest friend was relatively large, their heaviest friend was also fairly large. This correlation remained after controlling for the racial makeup of their closest friends, so it likely does not reflect only racial/ethnic homophily in peer groups. These significant associations suggest some clustering of similar weight peers when weight/shape is assessed using perceptual figure rating scales.

Next, correlations were computed separately by gender and race/ethnicity using multigroup comparison in AMOS and Fisher r to z transformations to determine whether the magnitudes of the correlations were different between subgroups. In gender comparisons, the correlation between self rating and friend ratings were significant for girls (r=.23 for thinnest friend and r=.33 for largest friend). For boys, self ratings were significantly related only to ratings of the largest friend (r=.21). This pattern suggests greater perceived similarity in body shapes among adolescent girls. The magnitude of difference was not statistically significant between boys and girls, indicating there was no moderating effect of gender.

Differences were also examined by race. Both Black and White adolescents' self FRS rating was moderately, positively correlated to their thinnest friend's figure size and largest

friend's figure size, and there were correlations between the thinnest and largest friends. Latino adolescents' self-figure rating was moderately, positively correlated to their largest friend's figure size and there was a correlation between these adolescents' thinnest and heaviest friends. Though correlations were largest for Black and White youth, the magnitude of difference was not significantly different.

Overall, the magnitudes of the correlations were generally bigger for females in comparison to males. In terms of race, the magnitude was bigger for Black and White adolescents compared to Latino adolescents, and this was particularly apparent in the correlation between an adolescent perceived size and that of her largest friend. Thus, the tendency for large people to have large friends was more evident for girls and for adolescents who identified as White or Black.

Research Question 2: Perceived friend size as a predictor of cognitions and behaviors

Body Evaluation: defining self as overweight and body satisfaction. Hierarchical logistic regression was used to examine whether the perceived size of close friends was predictive of whether or not adolescents judged themselves as overweight. The following factors were entered in blocks to reflect the potential influence on describing as overweight as follows: (Block 1) gender, minority status, ratio of white friends; (Block 2) self reported BMI, FRS self rating; (Block 3) FRS rating of thinnest friend, FRS rating of largest friend.

The full model containing all predictors was significant, X^2 (df = 8, N = 366)= 182.71, p < 001, indicating that the model was able to distinguish between respondents who reported and did not report being overweight. Of note, Block 3 including friend ratings was significant X^2 (df = 2, N = 366)= 10.72, $p < 0.01$. As shown in Table 4, five of the independent variables made a unique statistically significant contribution to the final model: gender, self reported BMI, FRS

self rating, FRS rating of thinnest friend, and FRS rating of largest friend. As expected, individuals with a higher BMI, or who rated themselves as having a relatively larger figure, were more likely to judge themselves as overweight. Beyond these effects, however, results indicate that the perceived size of closest friends has an independent effect on whether adolescents judge themselves as overweight. Interestingly, the direction of the odds-ratio for the thinnest friend (AOR = 0.61, 95% CI = 0.44-0.85) and largest friend (AOR = 1.31, 95% CI = 1.02-1.69) were in the opposite direction. In other words, having a relatively large friend and having a relatively thin friend both increased the likelihood that an adolescent would judge herself as overweight. This unexpected pattern of findings suggests that it may be the discrepancy in weight among close friend groups that increases the likelihood that an adolescent will view herself as overweight.

A linear regression analysis was carried out with body satisfaction as the dependent variable, and the factors listed above as the predictor variables. Factors were again entered in the same staged approach to control for covariates and confounds. These results are presented in Table 5. The overall model was significant ($F(8, 358) = 11.21$, $p < 0.001$), and explained a total of 0.05% of the variance. Block 1 (demographic factors) was significant and explained 4% of the variance, with gender the only significant predictor. Block 2 (BMI and FRS self rating) was significant and explained 15% of the variance, with BMI and FRS self-rating on body image reaching significance. Block 3 (largest and thinnest friend rating) was not a significant predictor of body satisfaction.

Weight Control Practices: dieting and exercise behaviors. Two hierarchical logistic regressions were run with recent dieting and exercise as the outcomes. These results are presented in Table 6 and 7. For recent dieting, the overall model was significant, X^2 (df=8,

N=364) = 153.38, $p < .001$, as was the final Block that included perceived friend figure sizes, X^2 (df=2, N=364) = 6.42, $p < 0.05$. As shown in Table 6, four of the independent variables made a unique statistically significant contribution to the final model: gender, self reported BMI, self FRS rating, and FRS rating of thinnest friend. As expected, individuals with a higher self-reported BMI or who rated themselves as having a relatively larger figure were more likely to report trying to lose weight. Beyond these effects, however, results indicate that an adolescent's perception of the size of her closest friends has an independent effect. Specifically, the effect is significant for the adolescent's perception of her thinnest friend. Thus, having a relatively thin friend increases the likelihood that an adolescent will report dieting behaviors.

For exercise, the overall model was again significant, X^2 (df=8, N=366) = 35.02, $p < .001$, as was the final Block that included perceived friend shapes, X^2 (df=2, N=366) = 5.92, $p < 0.05$. Only BMI made a significant contribution to the final model, and although Block 3 is significant, neither the figure size of an adolescent's thinnest nor heaviest friend uniquely predicted their report of exercising to lose weight.

Mental Health Outcomes: eating disorder and depressive symptoms. Using the same set of predictors, hierarchical linear regression analyses were carried out to explore symptoms of eating disorders and depression. Factors were again entered in the same staged approach to control for covariates and confounds. The results for eating disorder symptoms are presented in Table 8. About 20% of participants reported occasionally or frequently experiencing five or more disordered eating symptoms in the past several months. The overall model was significant ($F(8, 347)= 17.97$, $p < 0.001$), and explained a total of 29.3% of the variance. Block 1 (demographic factors) was significant and explained 12.6% of the variance, with gender the only significant predictor. Block 2 (BMI and FRS self rating) was significant and explained an

additional 14.5% of the variance, with self FRS rating and BMI on eating disorder symptoms reaching significance. Block 3 (largest friend rating and thinnest friend rating) was significant and explained an additional 2.2% of the variance, with the thinnest friend rating reaching significance on eating disorder symptoms.

For symptoms of depression, as seen in Table 9, the overall model was significant ($F(8, 358) = 5.68$, $p < 0.001$) and explained 11.4% of the variance. Only Block 1 (demographic factors) reached statistical significance and explained 10.5% of the variance, with gender as the only significant predictor.

Research Question 3: Moderation by gender and race/ethnicity

Moderation was tested with multigroup nested model comparisons using AMOS and Mplus. In both cases, nested models were used to compare overall fit of models with parameters of interest (friends size -> outcome) constrained to be equal across gender and freely estimated. When this nested comparison was significant, follow-up critical ratio tests were done to determine the specific parameter that varied by gender. Using this approach, constraining gender to be equal led to a significantly worse model for the body satisfaction (diff $X^2(2) = 18.47$, $p<.05$) and disordered eating outcomes (diff $X^2(2) = 6.39$, $p<.05$), but did not lead to a worse model for depression (diff $X^2(2) = 4.45$, $p = 0.11$), whether or not the adolescent said they were overweight.

For the categorical outcomes, tests of moderation indicated that constraining gender to be equal did not lead to a significantly worse model for the outcome of adolescents classifying themselves as overweight (diff $X^2(2) = 0.95$, $p = 0.62$), exercise to lose weight outcome (diff $X^2(2) = 3.90$, $p = 0.14$), or diet to lose weight (diff $X^2(2) = 1.58$, $p = 0.45$). Follow up pairwise critical ratio tests were conducted, as shown in Table 10 and Table 11. Although only two of the

six tests of moderation were statistically significant in model comparison, it is worth noting that the effect of friend size was larger for girls than boys for all outcomes. In addition, regression coefficients were typically non-significant for boys but significant for girls, suggesting the overall group effects were driven by girls even if parameters were not always significant different in magnitude. For body satisfaction and ED symptoms, the effects did differ significantly by gender. For body satisfaction, 4% of the variance was accounted for by the size of the thinnest and heaviest friend in girls, but 0% for boys. For ED symptoms, 9% of the variance in was accounted for by the figure size of the adolescent's friends for girls but only 4% for boys.

Race was tested in the same way, but there were no differences in the outcomes by racial/ethnic group for any outcome.

Research Question 4: Mediation by Peer Process Variables

To test for mediation, pearson correlations were first computed to examine correlations between the IV (friend size) and potential mediators (peer variables), and the mediators and DVs. Analyses demonstrated a small, negative correlation between the friend's preoccupation with weight and the FRS rating of the thinnest friend for the full sample, $r(386) = -0.17$, $p < .01$. Given the evidence of gender differences from research question 3, correlations were also examined by gender (see Table 12). There was a small, negative correlation between the friend preoccupation with weight variable and FRS thinnest friend rating for females, $r(192) = -0.16$, $p < .05$, but not for males. In other words, female adolescents who had friends who they viewed as relatively thinner were more likely to report that their friends were more preoccupied with weight. No other associations with peer process variables were found. Next, correlations among female participants between friends' preoccupation with weight and weight related cognition and

behavior variables (i.e., associations between mediators and DVs) were computed (see Table 13). Body satisfaction, eating disorder symptoms, and symptoms of depression were correlated with friend preoccupation with weight. Given this pattern of bivariate correlations, the potential mediation of adolescent girls friends' preoccupation with weight on the association between the size of an adolescent's thinnest friend and each of these outcomes was tested using mediation in SPSS and PROCESS. All mediation analyses were based on a bootstrapped sample of 2000.

As seen in Figure 1, friend preoccupation with weight significantly mediated the relationship between the size of the thinnest friend and the adolescent girl's body satisfaction. The indirect effect for body satisfaction was significant (indirect effect = 0.03, 95% CI = 0.004 to 0.08). The ratio of indirect to direct effect is 0.25, so 25% of the effect of minimum friend FRS rating on body satisfaction was due to friend preoccupation with weight. The indirect effect for eating disorder symptoms was also significant (indirect effect = -0.02, 95% CI = -0.16 to -0.05). The ratio of indirect to direct effects was 0.20, or in other words, 20% of the effect of minimum friend figure rating on eating disorder symptoms was due to friend preoccupation with weight (See Figure 2). The indirect effect for symptoms of depression was significant (indirect effect = -0.02, at a 95% CI -0.04 to -0.003). The ratio of indirect to direct effects was 0.40, so 40% of the effect of minimum friend on depression symptoms was accounted for by friend preoccupation with weight (See Figure 3).

Although these findings show some evidence of indirect effects, overall the results did not provide strong evidence of any of the measured peer variables acting as mediating mechanisms.

Discussion

Consistent with prevalence rates found in demographically similar samples (e.g., Whittemore, Jeon, & Grey, 2013), the average BMI of participants in this study fell within the overweight range, with over a third of participant's weight falling in the overweight or obese category. While this rate highlights the need to be concerned with overweight and obesity in this population, there was also evidence that many of these youth experience eating behaviors and attitudes typical of individuals with eating disorders. Indeed, approximately 20% of this sample reported five or more behaviors or cognitions typical of ED populations. In light of the prevalence and impact of both obesity and EDs on adolescents, it is critical to understand these risk factors within a social context. The current study tested for evidence of weight clustering among adolescents using perceptual measures of body shape, and examined whether the shape of peers is linked to several weight-related cognitions and behaviors that are typically associated with obesity and EDs.

Overall, adolescents in this sample who judged themselves as having a large figure had friends who they also viewed as relatively large. Among girls, this was true for both the adolescent's thinnest friend and heaviest friend, meaning if the adolescent rated her own body as relatively large compared to her peers, she also had a relatively large thinnest friend and a relatively large heaviest friend. For boys, those who judged their body as relatively large had relatively large heaviest friends, but there was no relation between the self-rating and the size of the thinnest friend. For both boys and girls, the perceived size of the largest and thinnest friends was positively correlated. It is important to note that these associations remained significant after controlling for racial makeup of friends, which may have been a confound in this diverse school setting. Consistent with previous research, these findings provide evidence for weight clustering among groups of peers (de la Haye et al., 2011, Hurschka et al., 2011; Trogdon et al.,

2008). While many past studies measured actual BMI, results from the current study add to the literature by demonstrating evidence of weight clustering at the perceptual level. This is important because how an adolescent perceives their body, or possibly the body of others, can be discrepant from actual BMI (Desmond, Price, Gray, & O'Connell, 1986), and it is often perceptual measures of body size that are more closely linked to mental health than actual weight measures (ter Bogt et al., 2006).

As hypothesized, we also found that weight clustering may impact cognitions and behaviors relevant to obesity and EDs. Six types of cognitions and behaviors were examined, including if the adolescent said they were overweight, felt body dissatisfaction, engaged in recent dieting, engaged in recent exercise to lose weight, and reported symptoms of depression or EDs. Consistent with past literature indicating that adolescents who perceive themselves as overweight are more likely to report unhealthy weight related cognitions and behaviors (Edwards et al., 2012), results from the current study found that larger adolescents were more likely to say they are overweight, have lower body satisfaction, diet and exercise more, and report a greater number of eating disorder symptoms. Interestingly, perceived size did not predict depression, although other studies have reported an association of perceived weight and depression (e.g., Schiefelbein et al., 2012). In these studies perceived weight was operationalized as defining oneself as underweight, normal weight, overweight or obese. In contrast, the FRS measure used in the current study had participants identify the body shape they believe is closest to their own from a range of body shapes. Thus, adolescents may have rated themselves as having a relatively larger size without viewing it in a negative way (i.e., as overweight).

As hypothesized, the figure sizes of the adolescent's friends were significant predictors of whether or not the adolescent identified as overweight, engaged in diet and exercise behaviors,

and endorsed eating disorder symptoms. In contrast, the perceived size of adolescent's friends did not predict body satisfaction or symptoms of depression for the full sample. However, tests of moderation suggest that looking at overall group effects may not be appropriate. In particular, gender moderated the strength of the association between friend figure size and body satisfaction, symptoms of depression, and disordered eating symptoms. Although gender was not a significant moderator in analyses with the other outcomes, in all cases the predictive power of friends' size was larger (and typically statistically significant) for girls. For girls, friend size added to the predictive model for all outcome variables except depressive symptoms and recent dieting. For boys, friends' size was not predictive of any outcome variable. Consequently, these results suggest the hypothesized relationships may only be evident among adolescent girls.

Among girls, the size of both their thinnest and largest friend was predictive of weight-related cognitions and behaviors. For judging oneself as overweight, the perceived size of the thinnest and heaviest friend uniquely predicted the likelihood that an adolescent viewed herself as overweight, even after controlling for perceptions of her own figure size and self-reported BMI. Specifically, the thinner an adolescent's thinnest friend, and the heavier her heaviest friend, the more likely she is to view herself as overweight. This same pattern of effects was found for body satisfaction and ED symptoms. That is, both the perceived sizes of the thinnest and heaviest friends were independently predictive of body satisfaction and ED symptoms. Again, having a particularly thin close friend or a particularly heavy close friend was associated with less body satisfaction and more ED symptoms.

The effect of the thinner friend is consistent with expectations: adolescents who have relatively large thinnest friend (i.e., none of their close friends are thin) may not have a "thin" referent, and thus may be less likely to see themselves as overweight. As a result, they may be

less accurate in their own evaluation of weight or their overweight status. If adolescents who are indeed overweight do not view themselves that way because they also have larger friends, they may not feel compelled to make any weight-related health changes.

In contrast, adolescents who have a particularly thin friend may feel less satisfied with their own body shape because they have a frequent reference for social comparison. Based on social comparison theory, adolescents who engage in weight-focused comparison to their peers are more likely to experience negative outcomes (Meyers & Crowther, 2009). Specifically, experimental research indicates that comparison to others who are "better off" (upward comparison) may have a greater impact on outcomes such as body satisfaction than comparison to others who are "worse off" (downward comparison) (Lin & Kulik, 2002; Wasilenko, Kulik, & Wanic, 2007). For adolescent girls, a friend who is viewed as thinner may be seen as "better off" given weight stigma and prevailing images of female attractiveness. This may result in increased body dissatisfaction or unhealthy attempts to control weight, as suggested in the current findings. Consequently, having a friend who is viewed as particularly thin may add to ED risk among adolescent girls. More broadly, results suggest the way girls perceive the size of their thinnest friend may have implications for both obesity and ED risk among low-income adolescents.

It is less clear why having a relatively heavy friend may also make one more likely to view themselves as overweight. Perhaps in peer relationships in which at least one member is relatively large, there is more focus on weight in personal conversations or from outside peer comments. Research indicates that being in close proximity to an overweight or obese person elicits negative judgment from others (Hebl & Mannix, 2003). As a result, girls with large friends may get more negative feedback about their own weight due to proximity to an obese friend, and as a result perceive themselves as larger.

It is also plausible that having a friend group with more heterogeneity (i.e., a very thin and a very heavy close friend) leads adolescents to notice, think about, or be more critical of their own weight because their weight referents are so different. Greater heterogeneity may make differences between oneself and others more evident, and thus increase comparative processes. Alternatively, because both thin and heavy people are stigmatized (Malloy, Lewis, Kinney, & Murphy, 2011), adolescents with both thin and heavy friends may be exposed to more stigma than if their friend group is more homogeneous. This may be particularly relevant among certain racial/ethnic groups that experience more weight-based stigma (Gray, Simon, Janicke, & Dumont-Driscoll, 2011).

Social comparison theory can also help explain why effects may have been moderated by gender (Leahey, Crowther, & Mickelson, 2007; Ridolfi, Myers, Crowther, & Ciesla, 2011). The literature demonstrates that girls engage in more social comparison than boys (Jones, 2001), and the effect of social comparison and weight related cognitive outcomes is stronger for females than males (Myers & Crowther, 2009; Kjelsås, Bjørnstrøm, & Götestam, 2004). Therefore, it may be that adolescent boys do not base their body satisfaction on the perceived size of their close friends and are perhaps more influenced by the larger social environment in their school and community (e.g., the size of popular peers) or media images (Franzini et al., 2009).

In the current study there were no significant moderations by race/ethnicity. However, racial/ethnic variance was not evident in the current study. This may be because other factors such as socioeconomic status or neighborhood features have a greater influence on adolescents in this particular sample. Alternatively, perhaps due to the significant peer influence during adolescence, youth may be more influenced by their peers than their parents, regardless of

cultural values. The subgroup analyses were also limited by power because of the small number of youth from each racial/ethnic group.

One goal of this study was to examine potential mediating factors that might account for relations between friends size and weight related cognitions and behaviors. As a first step for this analysis, bivariate correlations between friend size and peer process variables were computed. Somewhat surprisingly, neither negative peer comments about weight nor peer appearance based social standing beliefs were correlated to the figure size of adolescent's thinnest friend or heaviest friend. These results were unexpected because previous studies have shown that negative peer communication about weight is associated to weight related outcomes, such as maladaptive eating patterns (Kichler, Foster, & Opipari-Arrigan, 2008). Additionally, adolescents in highly weight conscious social groups report dieting concern among friends, weight related conversations with friends, peer teasing, and peer pressure to be thin (Paxton et al., 1999). It is possible that the current study did not capture all of the important peer processes that are predictors of weight related cognitions and behaviors. Alternatively, it may be that because appearance critique is so normal during adolescence, this constant peer influence mitigates the specific effects we expected to find.

Only friend preoccupation with weight was correlated (negatively) with the figure size of the adolescent girls' thinnest friend, suggesting that among adolescent girl peer groups with at least one relatively thin peer, there is more talk and concern about weight. These associations were small, however perhaps thin adolescent girls talk about weight more with their friends if they are actively trying to maintain a healthy weight, are particularly concerned with staying thin, or put a high value on a specific physical appearance. Alternatively, adolescent girls who have only heavy friends may avoid talking about weight with their friends.

Mediational analyses indicated that friend preoccupation with weight mediated the relationship between the figure size of the thinnest friend and body satisfaction, ED symptoms and depressive symptoms. In other words, part of the way in which having a particularly thin friend influences these outcomes is because in these peer groups there may be greater preoccupation and discussion of weight. Thus, it may not only be social comparison to particularly thin peers that contributes to body dissatisfaction and ED symptoms, but also specific peer processes that occur in these friendships. Consequently, there may be multiple venues for peer-based interventions.

Practice and Clinical Implications

The majority of the research on obesity and EDs in adolescents has been focused on the individual and public policy levels of the ecological model (Koplan, Liverman, & Kraak, 2005), however the current study provides evidence that efforts should be focused on the social aspects of the ecological model, and potentially to smaller networks or groups. If we intervene in social networks, it may be possible to prevent unhealthy weight related behaviors from developing into lifelong patterns. For example, if we target a high school class or entire grade level we would intervene with not only the at-risk or obese adolescents, but also with their underweight and healthy weight peers. Network wide intervention could prevent the normalization of certain unhealthy weight related cognitions and behaviors and decrease the amount of harmful social comparison within groups. It is particularly important to target low-income adolescents, as this is a population that tends to live in communities with higher obesity rates, while also experiencing the peer influences typical of adolescence. In particular, groups of low-income girls should be targeted because girls appeared to be driving the significant associations in this study.

Though many weight loss interventions focus on an individual's exercise and dieting behaviors, findings from the current study suggest we need to incorporate the social domain into weight loss interventions. Several interventions have already begun to include social components. The BodyImage3D initiative focuses on a multidimensional approach to body image awareness and education and is implemented in the Tri Delta sororities on college campuses. The BodyImage3D website asks viewers to take the "Fat Talk Free Pledge" that states "Today I promise to End Fat Talk in conversations with my friends, family and myself…"(Delta, Delta, Delta Fraternity, 2013). A few studies have begun to explore the relations between weight loss intervention and social factors during adolescence (Jelalian, Sato, & Hart, 2011), however more work is needed to understand how the size of adolescent's friends impact weight loss interventions. Future research should also explore the peer processes that may prevent or promote successful and healthy weight management.

Several social network interventions have successfully created behavior change by targeting and educating a group leader, who then motivated other group members to change their behavior (Kelly et al., 2006; Black-Becker, Bull, Smith, & Ciao, 2008). It may be possible to implement a similar strategy in peer based weight loss interventions among adolescents. In many high school peer groups there is a natural leader, if this leader were educated and motivated to teach their peer group about healthy eating and exercise, as well as deter their friends from engaging in negative conversations about appearance and weight, there may be widespread positive benefits.

Study Limitations and Strengths

This study did have some limitations, including the fact that it was cross-sectional, and may have not identified the effects of weight related cognitions and behaviors that change over

time. Another limitation of the present study was its reliance on self-report measures, which may have resulted in artificially inflated associations among measures. Additionally, the current study used measures of adolescent's perception of weight but did not use measures of actual weight. Though research suggests an individual's perception of their weight is a better predictor of quality of life than actual weight (Edwards et al., 2012), BMI measurements would provide additional information to better understand weight norms. For example, if most members of an adolescent's peer group are heavy, she may be more likely to rate her overweight friend as having a normal weight figure because being overweight is the norm in her social group. Similarly, some individuals misperceive their weight as heavier than they actually are, and this is especially true for individuals with low body satisfaction (Perrin, Boone-Heinonen, Field, Coyne-Beasley, & Gordon-Larsen, 2010). Thus, discrepancy between actual and perceptual measures of weight should be controlled for in future studies. Actual weight may also give us a better understanding of how adolescents are treated by their wider peer network. We know that overweight and obese adolescents are teased and criticized (Puhl, Luedicke, & Heuer, 2011), regardless of their own perception of their weight. Therefore, actual weight measurements would add to our understanding of the peer influence on adolescent obesity and EDs.

Other studies have found that peer processes, such as negative comments about weight, have a significant association to maladaptive eating patterns (Kichler et al., 2008). However, in our study only friend preoccupation with weight was significantly associated to cognitive or behavioral outcomes. It is possible that the PAS measure and NCS measure did not fully capture the peer processes that are interacting with the size of an adolescent's friends and her weight related cognitions and behaviors. Thus, future research should include alternative measures of peer processes that may be impacting weight related cognitions and behaviors.

Another study limitation is in regards to the generalizability of findings. Although participants in this study attend a racially/ethnically diverse high school, the number of adolescents who reported they were Asian or Indian was small, and these groups had to be collapsed into the "Other" category. Several adolescents also reported several races to describe their racial/ethnic identity. In the current study, if an adolescent reported more than one race they were categorized as "Other," however it may be beneficial for future questionnaires to ask which racial/ethnic culture the adolescent identifies with the most. This would have provided more clear evidence for racial/ethnic differences in weight related practices and beliefs.

There are several strengths of the present study. This study expands the body of research demonstrating the negative effects of social comparison and social norms on obesity and EDs by examining the influence of close friends. The present findings add to the limited research demonstrating the influence of the social context on adolescent's evaluation of their own weight (Paxton et al., 1999), weight related behaviors (Lau et al., 1990), and mental health (Fitzsimmons-Craft et al., 2012). Another strength of the current study is the inclusion of sub-clinical eating disorder symptoms, which is an indicator of future EDs (Goldschmidt et al., 2010) and possibly long-term weight gain (Herzog et al., 2010). Furthermore, the current study expands on prior research by assessing gender and racial/ethnic differences in a low-income community in relation to the social context of obesity and EDs. Few studies have examined gender differences in diverse communities (Robinson, Stevens, Kaufman, & Gordon-Larsen, 2010), and of those that did consider gender differences, many have not explored the social context of obesity.

Future directions and concluding statement

Future work should continue to use ecological models of health to understand the social context of obesity and EDs. Studying the longitudinal aspects of the social clustering of weight and related cognitions and behaviors would benefit our understanding of the social factors that influence weight among adolescents. In particular, longitudinal data would provide information as to whether friends who have dissimilar weights become more alike over time, and if adolescents tend to select new friends who are more similar in weight to themselves. Majority of the work done in this area has used actual weight measurements and only a few studies have used perceived weight measurements. Both of these measurement strategies have unique strengths, thus future research should measure both actual weight and perceived weight. This technique would also permit evaluation of the accuracy of adolescent's weight perception, and whether or not this accuracy contributes to weight related cognitions and behaviors.

It would also be helpful to understand the broader peer context within which adolescents socialize. It is possible that adolescents who are members of a group of friends that have relatively larger figures in a racially diverse community that is more accepting of larger figure sizes would have different experiences in an all White community that values the thin ideal. Finally, more work is needed to understand the specific peer processes that mediated the influence of the figure size of an adolescent's friends on her cognitive and behavioral outcomes. It is likely that the current study did not comprehensively assess the peer processes that impact these relationships.

In conclusion, the present findings support those of previous studies that found evidence for weight clustering (Christakis & Fowler, 2007). These findings also add to our understanding of the perceived weight of friends as a significant predictor of several weight related cognitions and behaviors in adolescents. Results of this study provide evidence for the social influence on

obesity and EDs within low-income communities, and also substantiate the extant literature suggesting the peer influence on weight is most apparent in adolescent girls.

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Table 1

Characteristics of Participants by Gender

Characteristic:	Total Sample	Boys	Girls	T-test difference
Racial/ethnic minority	79.4%	79.2%	79.5%	χ^2 =0.00, ns
BMI	23.02(4.49)	22.91(4.30)	23.14(4.71)	-0.50, ns
% describe self as overweight/obese	27.7%	23.7%	31.8%	χ^2 = 3.00, ns
Body satisfaction	3.70(0.86)	3.84(0.79)	3.55(0.89)	3.53, p<.001
% diet to lose weight	44.4%	32.0%	57.3%	χ^2 = 25.1, p<.001
% exercise to lose weight	41.8%	41.3%	42.3%	χ^2 = 0.01, ns
Disordered eating	1.32(0.37)	1.19(0.28)	1.45(0.41)	-7.27, p<.001
Depression	0.53(0.37)	0.42(0.31)	0.64(0.39)	-6.48, p<.001
FRS Perceived current body shape	4.56(1.30)	4.77(1.27)	4.34(1.30)	3.38, p = .001
Heaviest friend	5.56(1.34)	5.63(1.40)	5.48(1.27)	1.17, ns
Thinnest friend	3.19(1.11)	3.37(1.08)	3.00(1.10)	3.36, p< .001
Friends preoccupation with weight	2.32(0.93)	2.09(0.84)	2.55(0.97)	-5.01, p<.001

Table 2

Characteristics of Participants by Race

Characteristic:	Black	Latina	White	Other	F-test difference
BMI	23.14(6.00)	23.84(4.91)	21.38(2.90)	22.82(3.92)	5.53, $p = .001$
% describing self as overweight/obese	25.7%	34.2%	14.3%	27.5%	$\chi^2 = 11.56$, $p<.01$
Body satisfaction	3.82(0.90)	3.59(0.91)	3.67(0.74)	3.84(0.81)	2.08, ns
% diet to lose weight	41.2%%	49.2%	32.5%	46.1%	$\chi^2 = 6.69$, ns
% exercise to lose weight	54.3%	38.6%	47.0%	39.2%	$\chi^2 = 4.22$, ns
Disordered eating	1.24(0.27)	1.36(0.38)	1.29(0.41)	1.29(0.34)	1.53, ns
Depression	0.53(0.34)	0.57(0.39)	0.49(0.36)	0.49(0.36)	$\chi^2 = 1.55$, ns
FRS Perceived current body shape	4.74(1.67)	4.68(1.26)	4.30(1.13)	4.51(1.33)	1.92, ns
Heaviest friend	5.49(1.50)	5.57(1.29)	5.42(1.31)	5.69(1.41)	0.68, ns
Thinnest friend	3.08(1.17)	3.28(1.12)	3.04(1.06)	3.23(1.08)	1.23, ns
Friends preoccupation with weight	2.04(0.79)	2.40(0.96)	2.29(0.86)	2.28(0.86)	1.66, ns

Table 3

Correlations between FRS figure ratings of self, thinnest friend, largest friend, and range between thinnest and largest friends for total sample and by gender and race/ethnicity

	FRS Self-Thinnest Friend Correlation	FRS Self-Largest Friend Correlation	FRS Thinnest Friend-Largest Friend Correlation
Full Sample	.18***	.26***	.34***
BY GENDER:			
Male (n=205)	.08, ns	.21**	.32***
Female (n=197)	.23**	.33***	.34***
BY RACE:			
Latino (n=201)	.10	.19**	.33***
African American (n=85)	.22**	.28*	.40**
White (n=97)	.27**	.39**	.31**

* $p<.05$. ** $p<.01$. *** $p<.001$.

Note. All correlations control for the proportion of 4 closest friends who were identified as being White.

Table 4

Logistic Regression Predicting Perceived Self as Overweight

	ΔX^2	B(SE)	AOR(95% CI)
Block 1	11.89*		
Black		-0.88(0.56)	0.42(0.14-1.24)
Latino		-0.16(0.46)	0.85(0.35-2.10)
Gender		0.83(0.36)	2.30*(1.14-4.62)
%White friends		-0.66(0.71)	0.52(0.13-2.07)
Block 2	160.11***		
BMI		0.33(0.06)	1.40***(1.24-1.57)
Self FRS rating		0.70(0.19)	2.02***(1.39-2.94)
Block 3	10.72**		
Largest friend rating		0.27(0.13)	1.31*(1.02-1.69)
Thinnest friend rating		-0.49(0.17)	0.61**(0.44-0.85)

* $p<.05$. ** $p<.01$. ***$p<.001$.

Note. The overall model was significant X^2 (df=8, n=366)= 182.71, $p < .001$

Table 5

Linear Regression Body Satisfaction

	ΔR^2	Beta(SE)	B
Block 1	0.05**		
Black		0.14(0.14)	0.07
Latino		-0.08(0.12)	-0.05
Gender		-0.34(0.08)	-0.20***
%White friends		-0.29(0.17)	-0.11
Block 2	0.15***		
BMI		-0.04(0.01)	-0.21**
Self FRS rating		-0.14(0.05)	-0.21**
Block 3	0.005		
Largest friend rating		-0.04(0.03)	-0.07
Thinnest friend rating		0.04(0.04)	0.05

* $p<.05$. ** $p<.01$. ***$p<.001$.

Note. The overall model was significant $F(8, 358) \pm 11.21$, $p < 0.001$

Table 6

Logistic Regression Predicting Recent Dieting Behavior

	ΔX^2	B(SE)	AOR(95% CI)
Block 1	26.96***		
Black		-0.36(0.44)	0.70(0.30-1.63)
Latino		0.24(0.39)	1.27(0.60-2.70)
Gender		1.70(0.31)	5.48***(3.01-9.97)
%White friends		-0.08(0.54)	0.93(0.32-2.69)
Block 2	120.01***		
BMI		0.18(0.05)	1.20***(1.09-1.33)
Self FRS rating		0.76(0.17)	2.14***(1.52-3.00)
Block 3	6.42*		
Largest friend rating		0.15(0.11)	1.16(0.93-1.44)
Thinnest friend rating		-0.33(0.14)	0.71*(0.55-0.94)

* $p<.05$. ** $p<.01$. ***$p<.001$.

Note. The overall model was significant X^2 *(df*=8, *n*= 364)= 153.38, $p < .001$

Table 7

Logistic Regression Predicting Exercise Behavior with the Intention to Lose Weight

	ΔX^2	B(SE)	AOR(95% CI)
Block 1	6.13		
Black		0.35(0.36)	1.42(0.70-2.88)
Latino		-0.23(0.33)	0.80(0.42-1.51)
Gender		0.07(0.23)	1.07(0.68-1.70)
%White friends		-0.005(0.44)	0.99(0.42-2.36)
Block 2	22.98***		
BMI		-0.11(0.04)	0.90**(0.83-0.97)
Self FRS rating		-0.15(0.13)	0.86(0.67-1.12)
Block 3	5.92*		
Largest friend rating		0.17(0.09)	1.19(1.00-1.42)
Thinnest friend rating		0.11(0.11)	1.12(0.90-1.39)

* $p<.05$. ** $p<.01$. ***$p<.001$.

Note. The overall model was significant X^2 (df=8, n= 366)= 35.02, $p < .001$

Table 8

Linear Regression Disordered Eating

	ΔR^2	Beta(SE)	β
Block 1	0.13***		
Black		-0.04(0.06)	-0.05
Latino		-0.02(0.05)	0.03
Gender		0.27(0.04)	0.36***
%White friends		-0.02(0.07)	0.01
Block 2	0.15***		
BMI		0.01(0.01)	0.13*
Self FRS rating		0.33(0.02)	0.25**
Block 3	0.02**		
Largest friend rating		0.02(0.01)	0.06
Thinnest friend rating		-0.06(0.02)	-0.16**

* $p<.05$. ** $p<.01$. ***$p<.001$.

Note. The overall model was significant $F(8, 347) \pm 17.97$, $p < 0.001$

Table 9

Linear Regression Predicting Depression

	ΔR^2	Beta(SE)	β
Block 1	0.11***		
Black		0.05(0.06)	0.05
Latino		0.10(0.06)	0.14
Gender		0.22(0.04)	0.31***
%White friends		0.07(0.08)	0.06
Block 2	0.004		
BMI		0.01(0.01)	0.07
Self FRS rating		-0.01(0.02)	-0.01
Block 3	0.006		
Largest friend rating		0.02(0.02)	0.08
Thinnest friend rating		-0.01(0.02)	-0.01

* $p<.05$. ** $p<.01$. ***$p<.001$.

Note. The overall model was significant $F(8, 358) \pm 5.68$, $p < 0.001$

Table 10

The Moderating Effects of Gender Within the Association Between FRS of Friends and Continuous Outcome Variables Including Body Satisfaction, Disordered Eating, and Depression

	Boys					**Girls**				
	B(SE)	Beta	R^2	ΔR^2		B(SE)	Beta	R^2	ΔR^2	Z
Body Satisfaction			0.13	0.03	Body Satisfaction			0.26	0.04	
Thinnest	-0.04(0.05)	-0.05			Thinnest	0.13(0.06)	0.17*			2.11**
Largest	0.02(0.04)	0.03			Largest	-0.10(0.05)	-0.16*			-1.90
Disordered Eating			0.25	0.01	Disordered Eating			0.25	0.09	
Thinnest	0.02(0.02)	0.06			Thinnest	-0.12(0.03)	-0.33***			-4.03*
Largest	-0.02(0.01)	-0.08			Largest	0.05(0.02)	0.17*			2.58*
Depression			0.03	0.01	Depression			0.05	0.02	
Thinnest	0.03(0.02)	0.09			Thinnest	-0.05(0.03)	-0.15			-2.11**
Largest	0.02(0.02)	0.08			Largest	0.03(0.03)	0.09			0.32

* $p<.05$. ** $p<.01$. ***$p<.001$.

For both boys and girls, black, latino, racial make up of friends, BMI, Self FRS ratings were included as covariates.

Table 11

The Moderating Effects of Gender within the Association Between FRS of Friends and Continuous Outcome Variables Including Said Overweight, Exercise to Lose Weight, and Diet to Lose Weight

Boys				**Girls**				
	B(SE)	AOR(95% CI)	ΔX^2		B(SE)	AOR(95% CI)	ΔX^2	Z
Said overweight			2.62	Said overweight			8.14*	
Thinnest	-0.43(0.27)	0.65(0.38-1.12)		Thinnest	-0.47(0.22)	0.63(0.41-0.96)*		0.89
Largest	0.18(0.19)	1.20(0.82-1.75)		Largest	0.41(0.19)	1.51(1.04-2.19)*		-0.61
Exercise to lose weight			0.64	Exercise to lose weight			10.99**	
Thinnest	0.11(0.15)	1.12(0.83-1.50)		Thinnest	0.16(0.17)	1.17(0.84-1.63)		0.68
Largest	0.01(0.12)	1.01(0.80-1.28)		Largest	0.43(0.15)	1.54(1.14-2.08)**		1.59
Diet to lose			3.89	Diet to lose			3.81	
Thinnest	-0.37(0.20)	0.69(0.46-1.04)		Thinnest	-0.36(0.19)	0.70(0.48-1.02)		-1.06
Largest	0.21(0.16)	1.23(0.90-1.69)		Largest	0.14(0.16)	1.15(0.83-1.58)		-0.35

* $p<.05$. ** $p<.01$. ***$p<.001$.

For both boys and girls, black, latino, racial make up of friends, BMI, Self FRS ratings were included as predictors.

Table 12

Correlations for Peer Process Variables on Perceived Thinnest and Largest Friend

Peer Process Variable	FRS Thinnest Friend – Peer Process Variable Correlation	FRS Self-Largest Friend – Peer Process Variable Correlation
Friend Preoccupation with Weight		
Full Sample (N=386)	-0.17**	-0.06
Males (N= 192)	-0.10	-0.03
Females (N= 192)	-0.16*	-0.02
Negative Comments about Weight		
Full Sample (N= 399)	-0.06	-0.02
Males (N= 202)	0.01	0.02
Females (N= 195)	-0.12	-0.07
Appearance based social standing beliefs		
Full Sample (N= 403)	-0.03	0.06
Males (N= 202)	0.07	0.12
Females (N= 196)	-0.12	0.02

* $p<.05$. ** $p<.01$. *** $p<.001$.

Note. All correlations control for the proportion of 4 closest friends who were identified as being White.

Table 13

Correlation between Outcomes and Thinnest Friend FRS and Friend Preoccupation for Females

Outcome Variable	Friend Preoccupation with Weight	Thinnest Friend FRS
Perceive Self as Overweight	0.10	-0.03
Body Satisfaction	-0.20**	0.06
Diet to lose weight	0.03	-0.05
Exercise to lose weight	-0.10	0.12
Eating Disorder Symptoms	0.30***	-0.20**
Depression Symptoms	0.28***	-0.05

* $p<.05$. ** $p<.01$. *** $p<.001$.

Note. All correlations control for the proportion of 4 closest friends who were identified as being White.

Figure 1

Mediation of Friend Preoccupation With Weight on the Association Between Thinnest Friend FRS and Body Satisfaction for Females

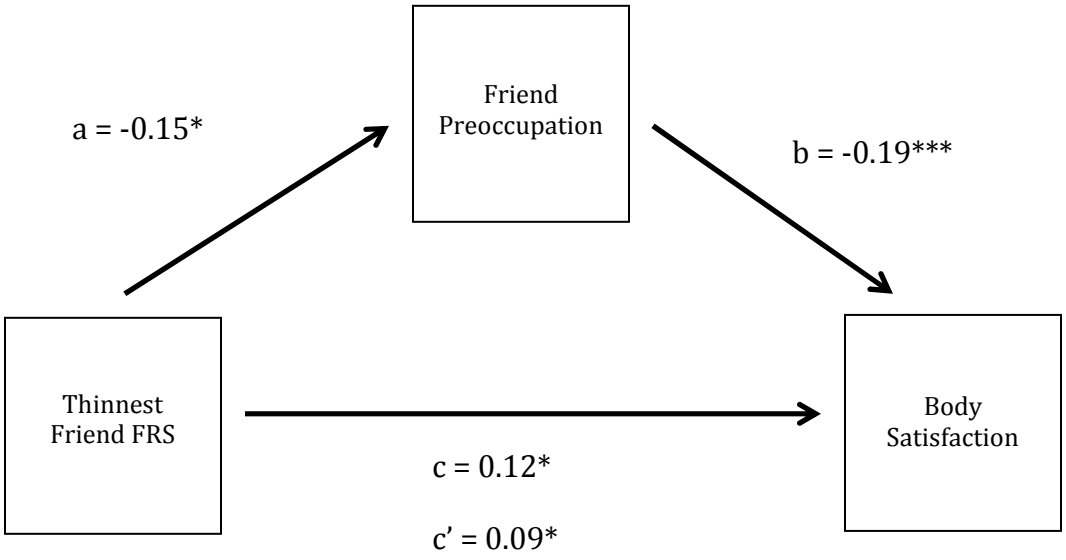

Figure 2

Mediation of Friend Preoccupation With Weight on the Association Between Thinnest Friend FRS and Eating Disorder Symptoms for Females

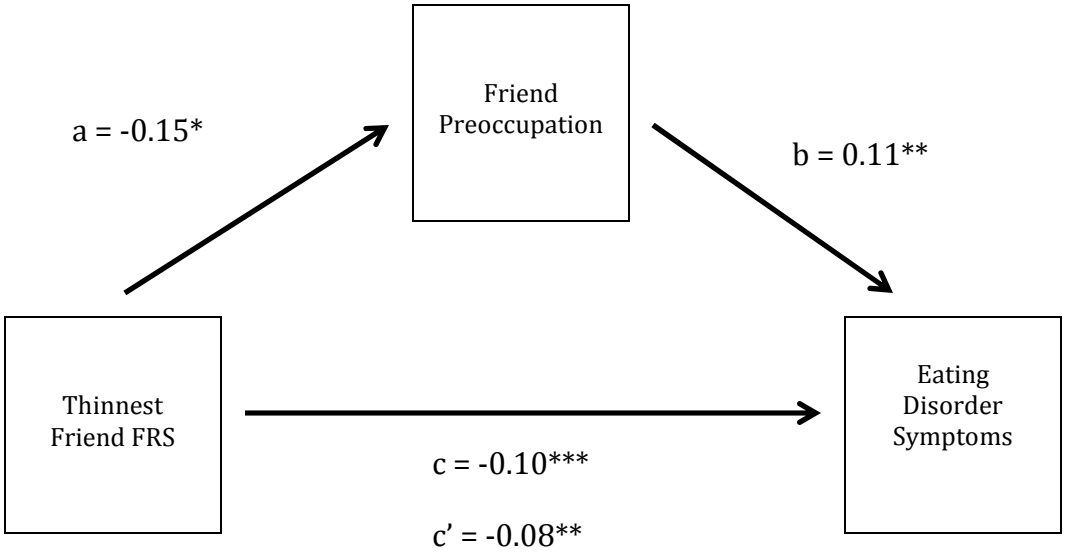

Figure 3

Mediation of Friend Preoccupation With Weight on the Association Between Thinnest Friend FRS and Symptoms of Depression for Females